

Appl. No. 10/649,450
Reply to Office Action of June 7, 2004

Docket No. ALLEG-039PUS

REMARKS

The above-identified patent application has been amended and Applicants respectfully request the Examiner to reconsider and again examine the claims as amended.

Claims 1-24 are pending in the application. Claims 1-11, 13-19, 21, 22, and 24 are rejected. Claims 12, 20, and 23 are objected to. Claim 19 is amended herein.

The Rejections under 35 U.S.C. §112, Second Paragraph

The Examiner rejects Claim 7 under 35 U.S.C. §112 second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Examiner asserts that it is unclear how the thickness of the clip is related to the current passing through the clip.

Applicants respectfully submit that one of ordinary skill in the art will understand how "...a thickness of the conductive clip is selected in accordance with a current passing through the conductive clip," as claimed. It is notoriously well known that a thickness of a conductor, to which a cross-sectional area of the conductor is related, affects a resistance of the conductor, and that a conductor having a larger thickness is preferred for passing more current.

In view of the above, Applicants submit that the rejection of Claim 7 under 35 U.S.C. §112, second paragraph, should be removed.

The Rejections under 35 U.S.C. §102(e)

The Examiner rejects Claims 1-3, 8, 9, 13, 14, 17-19, 21, 22, and 24 under 35 U.S.C. §102(e) as being anticipated by Ohtsuka (U.S. Patent number 6,683,448).

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Applicants submit that Claim 1 is patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "...a substrate having a first surface proximate to said current conductor portion and a second surface distal from said current conductor portion; and one or more magnetic field transducers disposed on the first surface of said substrate," as set forth in Claim 1.

With this particular arrangement, the present invention provides the one or more magnetic field transducers on a substrate mounted upside-down from a conventional arrangement relative to a lead frame on which it mounts. The claimed arrangement provides the one or more magnetic field transducers facing, and therefore, in close proximity to, a current conductor portion of the lead frame. As noted in the specification, "a current sensor is provided with one or more magnetic field transducers positioned in close proximity to the current conductor portion, resulting in improved sensitivity." (page 2, lines 24-26)

In contrast, Ohtsuka merely provides a conventional substrate mounting arrangement shown in FIG. 2 of Ohtsuka, wherein a Hall-effect device 1 is on a side of a substrate 18 away from a current path between current path terminals 3, 4. Ohtsuka does not describe or suggest the claimed arrangement having one or more magnetic field transducers on a surface of a substrate proximate to a current carrying conductor.

In view of the above, Applicants submit that Claim 1 is patentably distinct over Ohtsuka.

Claims 2-3, 8, 9, 13, 14, and 17-18 depend from and thus include the limitations of Claim 1. Thus, Applicants submit that Claims 2-3, 8, 9, 13, 14, and 17-18 are patentably distinct over the cited reference at least for the reasons discussed above in conjunction with Claim 1.

Applicants submit that Claim 2 is further patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "... said substrate is disposed having the first surface of

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said substrate above said current conductor portion and the second surface above the first surface," as set forth in Claim 2.

The arrangement of Claim 2 further describes the substrate mounting arrangement, which results in the first surface having the one or more magnetic field sensors being positioned facing the current carrying conductor.

With regard to Claim 2, the Examiner asserts that the claimed arrangement can be achieved by flipping the Ohtsuka detector of FIG. 1. Applicants respectfully submit that flipping the arrangement of FIG. 1 of Ohtsuka does not achieve the claimed arrangement, which results in the first surface having the one or more magnetic field sensors being positioned proximate to the current carrying conductor.

Applicants submit that Claim 3 is further patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "... said substrate is disposed having the first surface of said substrate below said current conductor portion and the second surface below the first surface," as set forth in Claim 3.

The arrangement of Claim 3, describes yet another substrate mounting arrangement, which results in the entire substrate being under the current carrying conductor, and wherein the first surface having the one or more magnetic field sensors is still positioned proximate to the current carrying conductor.

Applicants submit that Claim 9 is further patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "...said substrate is associated with a selected one of a solder ball, a gold bump, a eutectic and high lead solder bump, a no-lead solder bump, a gold stud bump, a polymeric conductive bump, an anisotropic conductive paste, and a conductive film coupled to a corresponding one of the plurality of leads," as set forth in Claim 9.

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With this particular arrangement, as shown in FIG. 6, the substrate 166 can be, for example, a flip-chip "having solder balls 160a-160c on the first surface 166a of the substrate 166," (page 12, line 23) wherein the substrate can be bonded to the lead frame without wires. Ohtsuka does not describe or suggests a solder ball, a gold bump, a eutectic and high lead solder bump, a no-lead solder bump, a gold stud bump, a polymeric conductive bump, an anisotropic conductive paste, or a conductive film as claimed, each of which are suitable for bonding a flip-chip as shown in FIG. 6.

Applicants submit that Claim 13 is further patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "... at least a portion of said current conductor portion has a rectangular cross section having a minimum dimension less than a thickness of said lead frame," as set forth in Claim 13.

The Examiner asserts that the arrangement of Claim 13 can be found in Ohtsuka in FIG. 2. Applicants can find no such arrangement in Ohtsuka and respectfully request clarification.

Applicants submit that Claim 14 is further patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "... at least one amplifier disposed on said substrate," as set forth in Claim 14.

With this arrangement, the one or more magnetic field sensors and the amplifier are integrated onto a single substrate.

The Examiner relies upon Ohtsuka at column 3, line 50 to teach the arrangement of Claim 14. At column 3, lines 46-51, referring to FIG. 9, Ohtsuka describes "the electrodes 12 and 13 are to be connected to a control current supply circuit 16 of well known construction for inputting a control current thereform, and the electrodes 14 and 15 to a differential amplifier 17 for putting out a Hall voltage, in use of this device." Applicants submit that Ohtsuka describes an amplifier separate from the substrate and not "...disposed on said substrate" as claimed.

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Applicants submit that Claim 17 is further patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "... a flux concentrator disposed proximate said one or more magnetic field transducers," as set forth in Claim 17.

The Examiner relies upon Ohtsuka at column 7, lines 44-47 to teach the claimed flux concentrator. At column 7, lines 44-47, referring to FIG. 9, Ohtsuka describes "...the current path through the baseplate is narrowed by creating straight slits 36-42. Concentrated current flow through this path results in an increase in magnetic lines of flux actually working on the Hall-effect device."

Applicants submit that the arrangement of Ohtsuka does not include a flux concentrator as claimed. One of ordinary skill in the art will understand that a flux concentrator operates to concentrate flux at a controlled region outside of the flux concentrator to provide increased flux density at the controlled region. In contrast, Ohtsuka describes a current path having a concentrated current flow, i.e., a current concentrator, which provides an increased flux density at all regions near the concentrated current flow.

For substantially the same reasons, Applicants submit that Claim 18 is further patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "... a flux concentrating layer disposed proximate the second surface of said substrate," as set forth in Claim 18.

Applicants have amended Claim 19 to require "... etching the current conductor portion to provide the current conductor portion with a cross section having a predetermined shape selected to provide an increased flux density." Support for this amendment can be found, for example, in the specification at page 3, lines 7-10.

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Applicants submit that amended Claim 19 is patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "... etching the current conductor portion to provide the current conductor portion with a cross section having a predetermined shape selected to provide an increased flux density," as set forth in amended Claim 19.

As described at page 3, lines 7-10, "[w]ith this particular arrangement, a current conductor portion is provided for which the flux density is more concentrated above a surface of the current conductor portion. Therefore, a magnetic field transducer mounted near the current conductor portion experiences an increased magnetic field, resulting in a current sensor having improved sensitivity."

In contrast, current path terminals 3, 4 of Ohtsuka and the current path between the current path terminals 3, 4 have a rectangular cross section. Furthermore, there is no teaching or suggestion that the Ohtsuka current path terminals 3,4 and current path are etched to provide a cross section having a predetermined shape selected to provide an increased flux density, as claimed.

In view of the above, Applicants submit that the rejection of Claim 19 under 35 U.S.C. §102(e) should be removed.

Claims 21, 22, and 24 depend from and thus include the limitations of Claim 1. Thus, Applicants submit that Claims 21, 22, and 24 are patentably distinct over the cited reference at least for the reasons discussed above in conjunction with Claim 1.

Accordingly, Applicants submit that the rejection of Claims 1-3, 8, 9, 13, 14, 17-19, 21, 22, and 24 under 35 U.S.C. §102(e) should be removed.

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The Rejections under 35 U.S.C. §103(a)

Ohtsuka in View of McDonald et al.

The Examiner rejects Claims 4-7 under 35 U.S.C. §103(a) as being unpatentable over Ohtsuka in view of McDonald et al. (U.S. Patent number 4,893,073). The Examiner recognizes that Ohtsuka does not describe or suggest the conductive clip of Claim 4. The Examiner relies upon McDonald et al. as teaching a conductive clip (20, Fig. 2). With regard to Claim 5, the Examiner relies upon McDonald et al. to teach a substrate disposed having a first surface above the conductive clip and a second surface above the first surface. With regard to Claim 6, the Examiner relies upon McDonald et al. to teach a substrate disposed having the first surface below said conductive clip and the second surface below the first surface. Regarding Claim 7, the Examiner relies upon McDonald et al. to teach a thickness of the conductive clip is selected in accordance with a current passing through the conductive clip.

Applicants submit that Claims 4-7 are patentably distinct over Ohtsuka, whether taken alone or in combination with McDonald et al., since the cited references neither describe nor suggest "...a substrate having a first surface proximate to said current conductor portion and a second surface distal from said current conductor portion; and one or more magnetic field transducers disposed on the first surface of said substrate," as required by Claims 4-7.

As described above, Ohtsuka neither describes nor suggests the claimed arrangement. Applicants submit that McDonald et al. fails to overcome the deficiencies in Ohtsuka. In Fig. 3, McDonald et al. shows a current trace 11 to the side of a magnetic sensor 30. A flux member 27, which is not a current carrying conductor, is disposed on top of the magnetic sensor 30. Therefore, Applicants submit that McDonald et al. neither describes nor suggests the claimed substrate having a first surface proximate to said current conductor portion and a second surface distal from said current conductor portion; and one or more magnetic field transducers disposed on the first surface of said substrate.

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Applicants submit that Claims 4-7 are further patentably distinct over Ohtsuka, whether taken alone or in combination with McDonald et al., since the cited references neither describe nor suggest that "...a current conductor portion further comprises a conductive clip coupled to the at least two of the plurality of leads," as required by Claims 4-7.

With this particular arrangement, the current passing through the current conductor portion, which is the current being measured, also passes through the conductive clip.

As described above, the Examiner relies upon McDonald et al. to teach a conductive clip to be a flux member 20 (FIG. 2). However, Applicants submit that all of the current being measured in McDonald et al. passes through the current trace 11 and that no current passes through the flux member 20. Therefore, Applicants submit that McDonald does not describe or suggest the claimed current conductor portion comprising a conductive clip.

Applicants submit that Claim 5 is further patentably distinct over Ohtsuka, whether taken alone or in combination with McDonald et al., since the cited references neither describe nor suggest "... said substrate is disposed having the first surface of said substrate above said conductive clip and the second surface of said substrate above the first surface," as set forth in Claim 5. Applicants submit that, even by flipping Ohtsuka, the claimed arrangement does not result. Further, McDonald et al. does not overcome this deficiency in Ohtsuka.

Applicants submit that Claim 6 is further patentably distinct over Ohtsuka, whether taken alone or in combination with McDonald et al., since the cited references neither describe nor suggest "... said substrate is disposed having the first surface of said substrate below said conductive clip and the second surface below the first surface," as set forth in Claim 6. Applicants submit that, even by flipping Ohtsuka, the claimed arrangement does not result. Further, McDonald et al. does not overcome this deficiency in Ohtsuka.

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In view of the above, Applicants submit that Claims 4-7 are patentably distinct over Ohtsuka, whether taken alone or in combination with McDonald et al.

In View of Ohtsuka

The Examiner rejects Claims 10, 11, 15, and 16 under 35 U.S.C. §103(a) as being unpatentable over Ohtsuka. The Examiner asserts that Ohtsuka teaches an amplifier. The Examiner recognizes that Ohtsuka does not disclose multiples of said one or more magnetic field transducers. The Examiner concludes that it would have been obvious to one having ordinary skill in the art to have multiple transducers, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art.

As an initial matter, Applicants respectfully point out that Claims 10 and 11 do not teach an amplifier as suggested by the Examiner. Never the less, Applicants assume that the Examiner intended to reject all of Claims 10, 11, 15, and 16 under 35 U.S.C. §103(a) as being unpatentable over Ohtsuka.

For the above-described reasons, Applicants submit that Claim 10, 11, 15, and 16 are patentably distinct over Ohtsuka, since the cited reference neither describes nor suggests "...a substrate having a first surface proximate to said current conductor portion and a second surface distal from said current conductor portion; and one or more magnetic field transducers disposed on the first surface of said substrate," as required by Claims 10, 11, 15, and 16.

Applicants submit that Claims 15, and 16 are further patentably distinct, since the cited reference neither describes nor suggests "...at least one amplifier disposed on the substrate," as required by Claims 15 and 16.

With this arrangement, a substrate is provided having both the claimed one or more magnetic field transducers and the claimed at least one amplifier disposed thereon.

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As described above, at column 3, lines 46-51, referring to FIG. 9, Ohtsuka describes "the electrodes 12 and 13 are to be connected to a control current supply circuit 16 of well known construction for inputting a control current thereform, and the electrodes 14 and 15 to a differential amplifier 17 for putting out a Hall voltage, in use of this device." Applicants submit that Ohtsuka describes an amplifier separate from the substrate and not "...disposed on the substrate" as claimed.

In view of the above, Applicants submit that Claims 10, 11, 15, and 16 are patentably distinct over Ohtsuka.

Accordingly, Applicants submit that the rejection of Claims 4-7, 10, 11, 15, and 16 under 35 U.S.C. §103(a) should be removed.

The Claim Objections

The Examiner objects to Claims 12, 20, and 23 as being dependent upon a rejected base claim, but indicates that these claims would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claim.

For the above reasons, Applicants submit that independent Claim 1, from which Claim 12 depends, is patentably distinct over the cited references. Also for the above reasons, Applicants submit that independent Claim 19, from which Claims 20 and 23 depend, is patentably distinct over the cited references. Therefore, Applicants submit that Claims 12, 20, and 23 are allowable in their present dependent form.

In view of the above Amendment and Remarks, Applicants submit that Claims 1-24 and the entire case are in condition for allowance and should be sent to issue and such action is respectfully requested.

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The Examiner is respectfully invited to telephone the undersigning attorney if there are any questions regarding this Amendment or this application.

The Assistant Commissioner is hereby authorized to charge payment of any additional fees associated with this communication or credit any overpayment to Deposit Account No. 500845.

Respectfully submitted,

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